Boulder Creek Fuels Restoration Project

Fuels Specialist Report

Hume Lake Ranger District

Sequoia National Forest

Giant Sequoia National Monument

Prepared By: ___/s/Paul Leusch_____ Date: __10/31/2012_____

Paul Leusch
Fuels Specialist
Hume Lake Ranger District

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Introduction

The Boulder Creek Fuels Restoration Project is located within the Sequoia National Forest and Giant Sequoia National Monument on the Hume Lake Ranger District. The project proposal includes the use of prescribed fire within the lower portion of the Boulder Creek drainage to restore ecological processes and improve overall fuel and vegetative conditions.

The proposed activities would use prescribed fire to reintroduce fire into the ecosystem. Not all of the project area would be burned, based on the desire to limit smoke production, protect established plantations and cultural resources, and varied topographical and fuel conditions. An estimated 6,000 to 9,000 acres of the total 14,000 project area would actually be burned over the five year duration of the burning treatments.

Location

The project area is bounded on the east by the 2010 Sheep Fire, the south by the 14S14 Road, the west by the Evans Giant Sequoia Grove Complex, and the north by State Highway 180 and the Kings River. The planning area includes portions of Monarch Wilderness not burned by the Sheep Fire, Agnew Roadless Area, the Wild and Scenic South Fork of the Kings River, three giant sequoia groves, and the proposed Windy Gulch Geologic Area (Map 4).

The project area lies within the following legal location:
Township 14S Range 29E Section 2 and 3.
Township 13S Range 29E Section 3-6, 8-17, 20-29, 32-36.
Township 13S, Range 30E Section 7, 18, 19, 30, 31.

Background

The ecology of the Sierra Nevada Range has been heavily influenced by the role of fire for over a thousand years. Prior to Euro-American settlement, fires were frequent throughout much of the range. The frequency and severity of these fires varied spatially and temporally based upon climate, elevation, topography, vegetation, and edaphic conditions. The mixed severity fires affected the dynamics of biomass accumulation and nutrient cycling, and generated vegetation mosaics on a variety of special scales.

Management strategies in the twentieth century have reduced the influence of fires' role in the ecosystem and contributed to the forest conditions that encourage high-severity fires. Live and dead fuels increased along with the development of denser brush and mixed conifer forests. The higher stand densities are concentrated mainly in the small and medium classes of shade-tolerant, fire- sensitive species. The result has been an increase in the amount and continuity of live and dead forest fuels providing a link between surface and canopy fuels.

The majority of the Boulder Creek drainage has missed the last five fire return intervals (100+ years of fire exclusion). It is in steep inaccessible terrain with a moderate to heavy fuel layer, contained mostly in the Agnew Roadless Area, Monarch Wilderness, Deer Meadow Giant Sequoia Grove, Agnew Giant Sequoia Grove, and Evans Giant Sequoia Grove Complex.

The project area is comprised mainly of mixed conifer, ponderosa pine, and live oak overstory, while the understory contains mainly bearclover, greenleaf manzanita, and whitethorn. Trees, including areas of giant sequoia and pinyon pine, are now competing with each other for water, nutrients, and growing

space. There is also a heavy dead and down woody fuels component in the project area. The vertical and horizontal continuity of the fuel loading provides a ladder for fire to transition from low intensity surface fire to an active crown fire.

The proclamation that established Giant Sequoia National Monument identified a need for forest restoration both in the sequoia groves and the surrounding forest to counteract the effects of a century of fire suppression and logging.

Relevant Laws, Regulations, and Policy

The applicable management direction for this action is currently reflected in the U.S. Department of Agriculture (USDA), Forest Service, Sequoia National Forest, the 1988 Sequoia National Forest Land and Resource Management Plan, as amended by the 2012 Giant Sequoia National Monument Final Environmental Impact Statement, . This action is also in compliance with the 2000 Presidential Proclamation establishing the Giant Sequoia National Monument (Clinton 2000).

Pertinent desired fire and fuels conditions for the Boulder Project include:

- Fire occurs in its characteristic pattern and resumes its ecological role. Frequent fire maintains lower, manageable levels of flammable materials in most areas, especially in the surface and understory layers (Giant Sequoia National Monument FEIS, 2012).

- The need to maintain fuel conditions that support fires characteristic of complex ecosystems is emphasized and allows for a natural range of fire effects in the Monument (Giant Sequoia National Monument FEIS, 2012).

Analysis Questions

This report analyzes the impacts to the fire and fuels resource from federal activities proposed in the Boulder Creek Fuels Restoration Project and discloses the potential effects of the alternatives. The report outlines the regulatory direction, which guides the development of management activities and the issues addressed. It discusses the methodology of analysis, summarizes the existing, and addresses the direct, indirect, and cumulative effects of all the alternatives relating to fire and fuels management. Flame lengths, rate of spread, fireline intensity, and crown fire activity have been identified for use in the metrics comparing the alternatives and their effects on fire and fuels management. The components of the matrix will measure the effectiveness of the fuel treatments across the project landscape based on the potential of a wildfire before and after treatments have been completed.

Affected Environment

Existing Condition

The project area is best described as an arid to semi-arid climate with dry summers and cool wet winters. Precipitation averages approximately 31 inches per year with the majority of the accumulation occurring between November and March of each year. Average high temperatures of 87° F occur in the months of July and August. Average low temperatures for the same time period drop to 48°- 55° F.

The majority of the area has missed the last five fire return intervals (100+ years of fire exclusion). It is in steep inaccessible terrain with a moderate to heavy fuels layer. The arrangement of fuels is such that the vertical and horizontal continuity provide ladder fuels that enable low intensity surface fires to potentially move into the canopies and become crown fires. The combination of topography, vegetation, and fuel loading are such that a wildfire could not be safely suppressed under extreme conditions. Such a fire would not only be a threat to giant sequoia trees, but also to life, property, and other resources in the area, such as wildlife habitat, cultural sites, plantations, and recreation improvements.

The Agnew Grove was inventoried in 2009. This grove is unique in that it is both in a roadless area and since 1984 has been part of the Monarch Wilderness land allocation. Available forest management records date back to 1955 and fire history information is available back to 1910. In Agnew Grove there are no records of past management activities and no fire history, natural or human caused, for fires ten acres or larger. Surface fuel loading conditions during the inventory year of 2009 including duff and litter, are approximately 24 tons of fuel per acre. Grove density and tree stocking included approximately 238 trees per acre, with the majority of the trees in the less than 20 inch diameter class. At the time of the inventory white fir made up more than 86% of the trees per acre and almost 70% of the basal area. All other species combined, including hardwoods, made up slightly more than 30% of the total basal area, with 22% of that being sequoia trees. The increased number of shade tolerant trees, particularly in the 10-16 inch diameter size class, can be attributed to lack of fire throughout the grove (Wood 2010).

The Deer Meadow Grove was inventoried in 2009. Forest management records show no recorded management activities or fire history, for fires ten acres or larger in the grove. Surface fuel loading conditions during the inventory year of 2009 including duff and litter, are approximately 17 tons of fuel per acre. Grove density and tree stocking included approximately 484 trees per acre, with a mean diameter of 9.3 inches.

The Evans Giant Sequoia Grove Complex was inventoried in 2009. Some management activities, including harvest, tree planting, and prescribed fire have occurred within the grove complex. These areas are shown on the grove disturbance map below. Fire history records show 501 acres of fires ten acres and larger have burned in the grove since 1916. Surface fuel loading conditions including duff and litter, are approximately 43 tons of fuel per acre. Grove density and tree stocking included approximately 505 trees per acre, with a mean diameter of 7.7 inches.

Giant sequoias should account for approximately 55-75% of total basal area and >10% of the total trees. The mixed conifer component should contain 25-45% of the total basal area with white fir being the dominant species. Incense cedar, sugar pine, and black oak are also important components of most groves, but even in combination should occupy <20% of the total basal area (Piirto 1999).
The remainder of the project area is comprised mainly of mixed conifer, ponderosa pine, and live oak overstory. The understory is primarily made up of bearclover, greenleaf manzanita, and whitethorn. Due to fire suppression, trees including areas of giant sequoia and pinyon pine, are now competing with each other for water, nutrients, and growing space. The vertical and horizontal continuity of the fuel loading provides a ladder for fire to transition from low intensity surface fire to an active crown fire.

Topography

The Boulder Creek project area and adjacent lands generally have a north/ south drainage alignment and consist of steep rugged terrain (Figure 1) with many ephemeral and intermittent streams flowing

into perennial drainages that feed the South Fork of the Kings River. Aspects vary depending on the drainage but the general orientation is northerly.

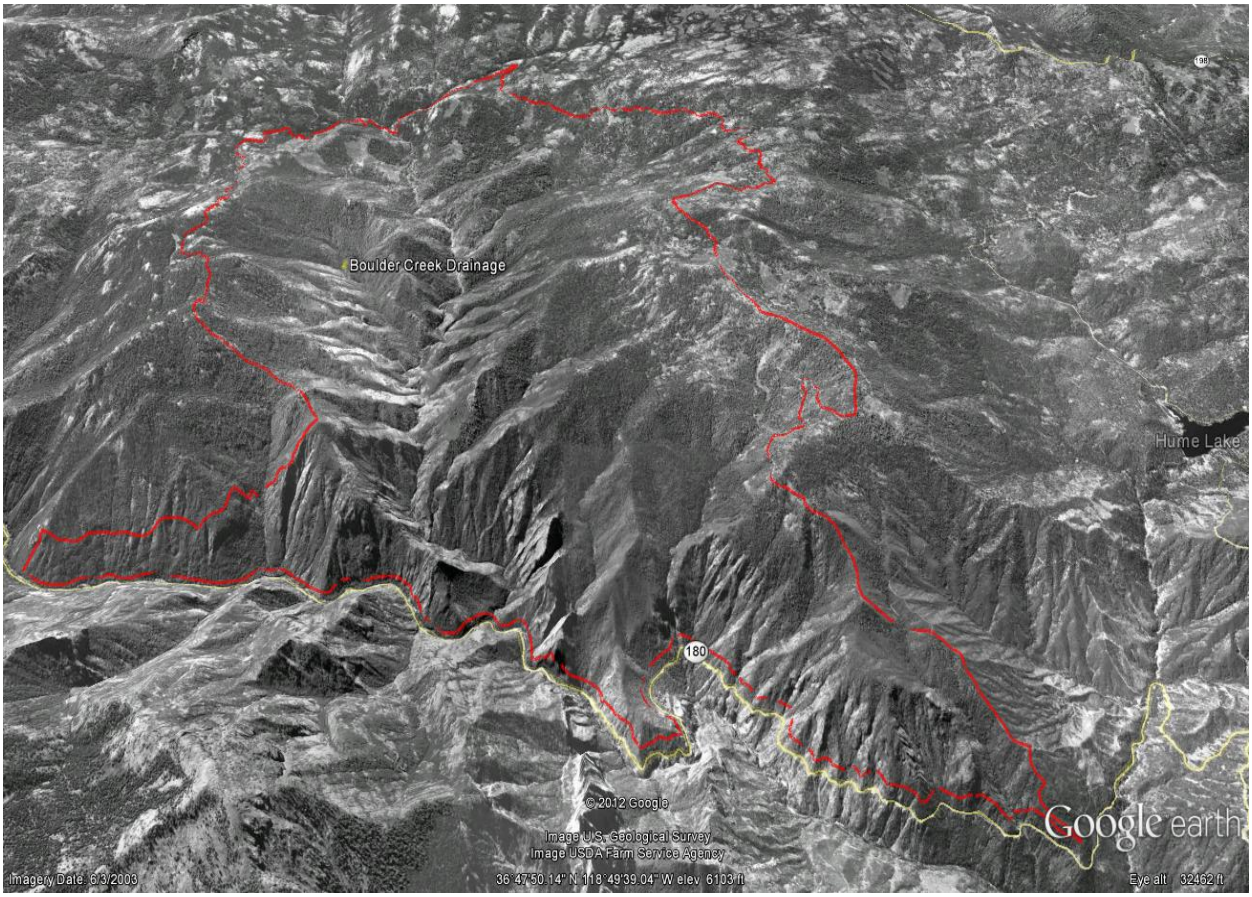


Figure 1: View from the north overlooking the Kings River (Highway 180) and south into the Boulder Creek drainage. The project boundary is outlined in red following roads and ridges. The elevation ranges from 3600 to 8200 feet. The majority of the slopes exceed 30 percent, with numerous ridges aligned northeast and southwest within the main Boulder Creek drainage.

Fuels

The fuel models within the Boulder Creek drainage were determined utilizing Standard Fire Behavior Fuel Models found in Sequoia National Forest and Giant Sequoia National Monument fuels data and Wildland Fire Decision Support System (WFDSS) California Landscape 2010 fuels data. The description of these models can be found in Scott and Burgan 2005, A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. This set of fuel models was developed to improve the accuracy of fire behavior predictions outside of the severe period of the fire season, such as prescribed fire and fire use applications.

The fuel model dataset is categorized into seven fire-carrying fuel types, non-burnable (NB), grass (GR), grass-shrub (GS), shrub (SH), timber-understory (TU), timber-litter (TL), and slash-blowdown (SB). Six of the fuel types are represented in the project area and are described below.

- Non-burnable (NB): In all of the NB fuel models there is no fuel load. Wildland fire will not spread. There are five models within the NB category, urban/developed (NB 91), snow/ice (NB 92), agricultural (NB 93), open water (NB 98), and bare ground (NB99).

- Grass (GR): The primary carrier of fire in the GR fuel models is grass. Grass fuels can vary from heavily grazed grass stubble or sparse natural grass to dense grass more than 6 feet tall. Fire behavior varies from moderate spread rate and low flame length in the sparse grass to extreme spread rate and flame length in the tall grass models. All GR fuel models are dynamic, meaning that their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong (Scott and Burgan, 2005).

- Grass-Shrub (GS): The primary carrier of fire in the GS fuel models is grass and shrubs combined; both components are important in determining fire behavior. All GS fuel models are dynamic, meaning that their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model (Scott and Burgan, 2005).

- Shrub (SH): The primary carrier of fire in the SH fuel models is live and dead shrub twigs and foliage in combination with dead and down shrub litter. A small amount of herbaceous fuel may be present, especially in SH1 and SH9, which are dynamic models (their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content). The effect of live herbaceous moisture content on spread rate and flame length can be strong in those dynamic SH models (Scott and Burgan, 2005).

- Timber-Understory (TU): The primary carrier of fire in the TU fuel models is forest litter in combination with herbaceous or shrub fuels. TU1 and TU3 contain live herbaceous load and are dynamic, meaning that their live herbaceous fuel load is allocated between live and dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model (Scott and Burgan, 2005).

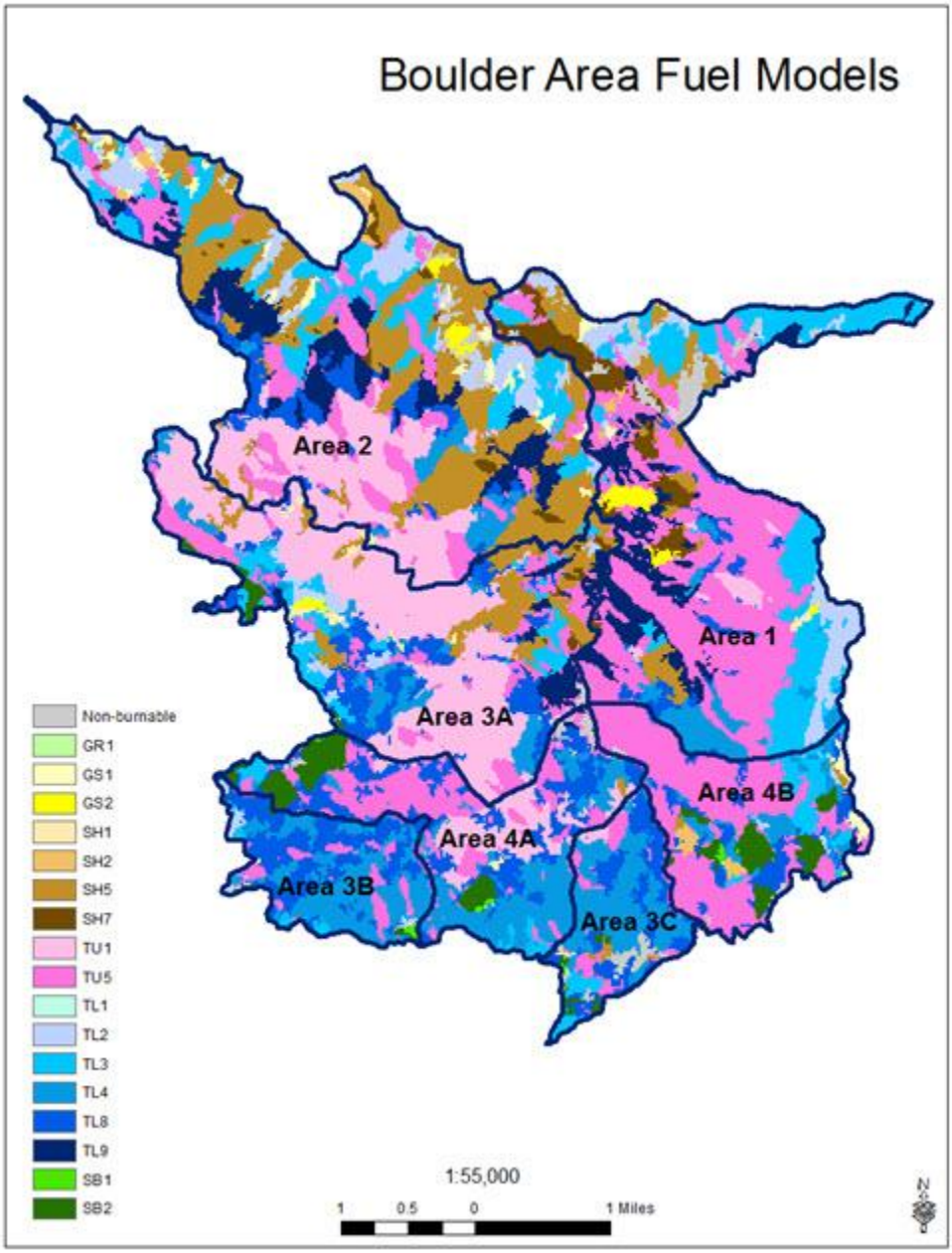
- Timber-litter (TL): The primary carrier of fire in the TL fuel models is dead and down woody fuel. Live fuel, if present, has little effect on fire behavior (Scott and Burgan, 2005).

The Boulder Creek project area has 19 different fuel models represented in the project area, which range from NB1 (Non-Burnable, 91) and NB9 (Non- Burnable, 99) to TL9 (Timber Litter, 189). However three fuel types, including TU5, TL4, and TL6 comprise approximately 77.27 % of the project area, while the remaining 16 fuel models make up the final 22.73 % of the area. Table 1 displays the fuel model code, description, acres and the percent of the project area occupied by each fuel model. Map 1 depicts the distribution of the fuel models across the landscape.

Table 1: Fuel model code, description, acres, and percent of the project area

Fuel Model Code	Fuel Model Description	Acres	Percent of Project Area
NB1	Urban/Developed	8	0.1
NB9	Bare Ground	232	1.6
GR1	Short, Sparse, Dry Climate Grass	2	0.0
GS1	Low Load, Dry Climate Grass-Shrub	147	1.0
GS2	Moderate Load, Dry Climate Grass-Shrub	94	0.7
SH1	Low Load, Dry Climate Shrub	55	0.4
SH2	Moderate Load, Dry Climate Shrub	79	0.5
SH5	High Load, Dry Climate Shrub	1,617	11.2
SH7	Very High Load, Dry Climate Shrub	303	2.1
TU1	Low Load, Dry Climate Timber-Grass-Shrub	2,045	14.2
TU5	Very High Load, Dry Climate Timber-Shrub	3,271	22.7
TL1	Low Load, Compact Conifer Litter	10	0.1
TL2	Low Load Broadleaf Litter	671	4.7
TL3	Moderate Load Conifer Litter	1,490	10.4
TL4	Small Downed Logs	1,567	10.9
TL8	Long Needle Litter	1,607	11.2
TL9	Very High Load Broadleaf Litter	848	5.9
SB1	Low Load Activity Fuel	16	0.1
SB2	Moderate Load Activity Fuel/Low Load Blowdown	325	2.3

Map 1: Fuel models and location across the project area



Fire Return Interval / Fire Return Interval Departure

Fire return interval describes how often fires occurred historically (pre-European settlement) in a particular location and vegetation type. Fire Return Interval Departure (FRID) is a temporal attribute of the fire regime that is measured by determining when fire occurred last on each of the acres in the area and comparing this with the fire return interval for the locale and vegetation type. Fire Return Interval Departure (FRID) is an indicator of how close the area is to the historic fire regime. Some attributes of the fire regime that would not be addressed by simply putting fire back into the ecosystem are: seasonality, severity, intensity, fire type, and complexity.

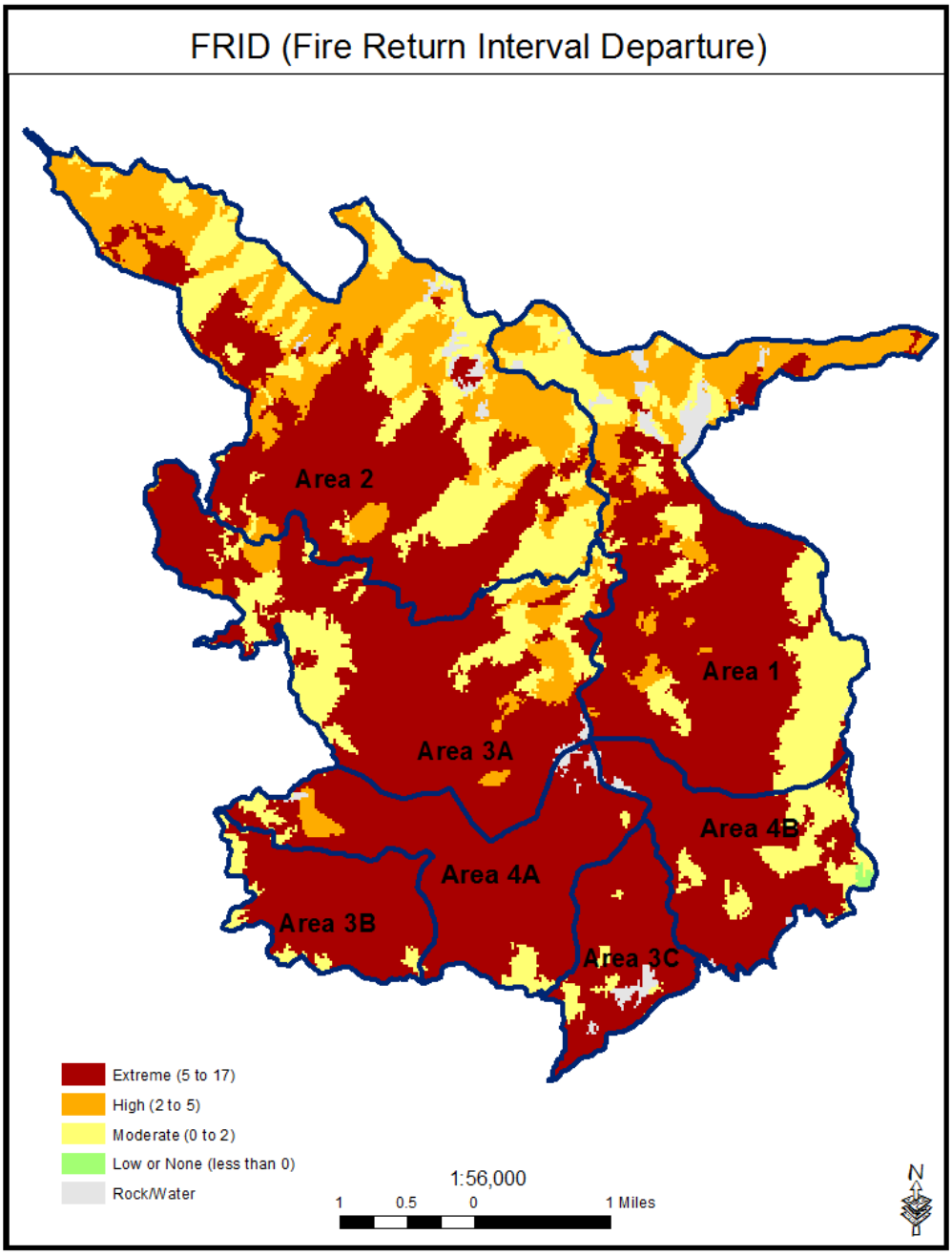
Fire history studies in the southern Sierra Nevada show intervals between fires ranging from 2 years, through 8 to 10 years for large fires in the Sierra, generally to 20-25 years in a given locality of a sequoia grove (Kilgore and Taylor 1979). This study indicates that lack of frequent, light fire has resulted in a major departure from conditions which normally evolve under giant sequoias during the past 1000 years or more (Kilgore and Taylor 1979). Research in the Giant Forest of the Sequoia and Kings Canyon National Parks, adjacent to the Sequoia National Forest, shows that over three millennia during the warmest and driest periods the fire return interval was the shortest (Swetnam et al. 2009). Fire-scar studies in giant sequoia groves in Yosemite National Park, Sequoia and Kings Canyon National Parks, and Mountain Home Demonstration State Forest, CA, suggest that mean fire return intervals were as low as 2.5–3 yrs for more than 1300 yrs from AD 500–AD 1875. Occasionally, fire-free intervals of 20–30 yrs occurred in the record (Swetnam et al. 1992; Swetnam 1993).

The fire return interval for a given vegetation type can be used in conjunction with fire history maps to determine which areas have missed natural fires. This information is known as the Fire Return Interval Departure (FRID). A Fire Return Interval Departure (FRID) map was developed by Sequoia and Kings Canyon National Parks from vegetation, fire history, and historic fire frequency data to assess the departures from the historical fire return interval in areas within the Giant Sequoia National Monument. A FRID index was classified into five categories: extreme 5- 17 intervals missed, high 2- 4.9 intervals missed, moderate 0- 1.9 intervals missed, low <0 intervals missed, and rock/water. As the departure from the fire return interval increases, so would the severity and intensity of a fire which occurs. Table 2 depicts the FRID classes for the Boulder Creek project area and acres in each class. Map 2 shows the location of each FRID class within the project area.

Table 2: Fire Return Interval Departures (FRID) and associated acres

Fire Return Interval Departures	Class	Acres
5 - 17 intervals missed	Extreme	8,872
2 - 4.9 intervals missed	High	2,134
0 – 1.9 intervals missed	Moderate	2,930
< 0 intervals missed	Low	12
	Rock/water	241

Map 2: Fire Return Interval Departure (FRID) classes in the Boulder Creek Drainage



Fire History

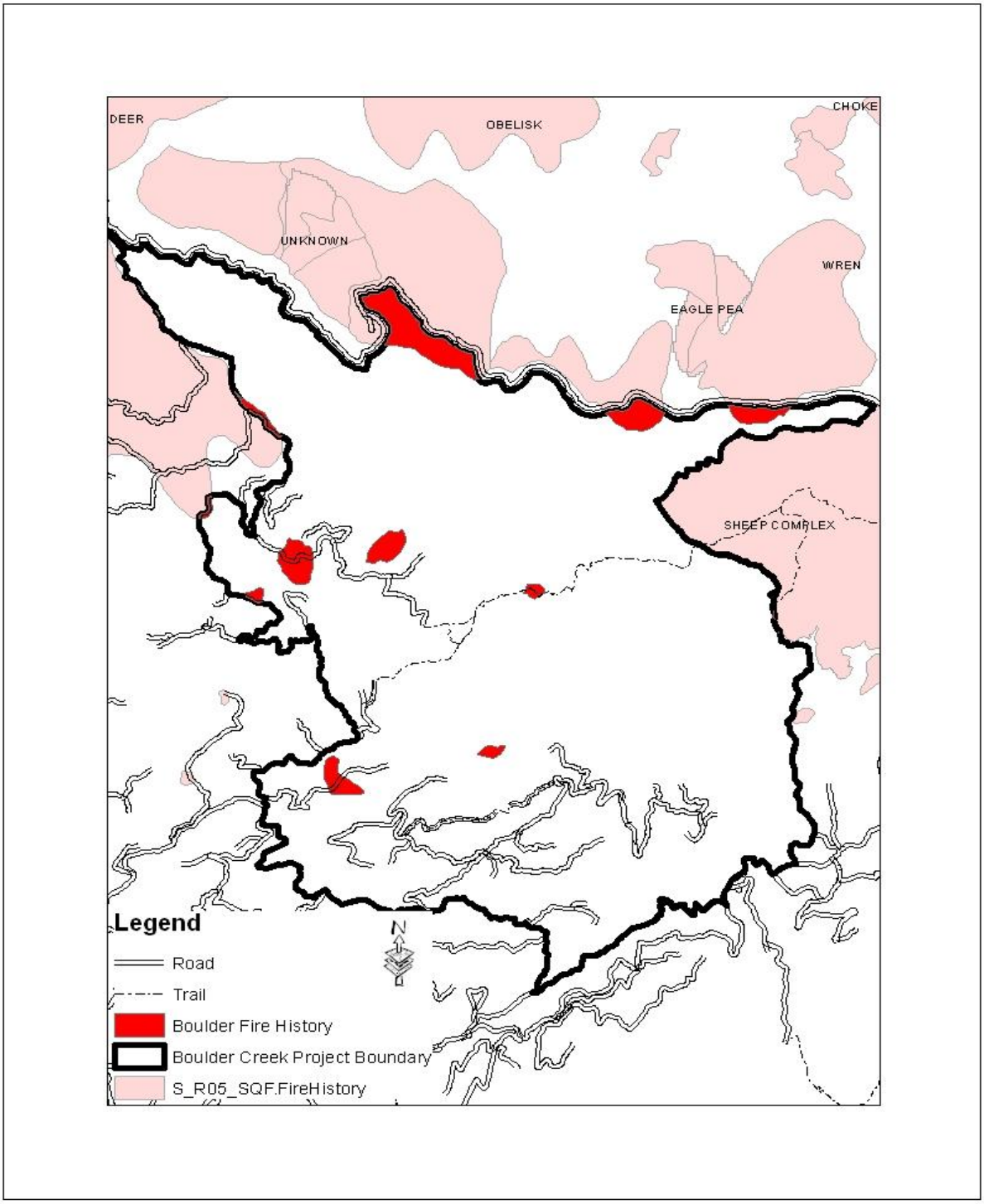
Fires in the Boulder Creek geographic area tend to be wind and slope driven. The Kings River on the northern boundary of the project area, along with steep rocky terrain provide an effective barrier to fire spread into the Boulder Creek drainage.

The fire history for the Boulder Creek drainage dates back to the early 1900's, during which time 11 fires have burned in or onto land within the project area. The 11 fires, both natural and human caused, total approximately 448.2 acres (Table 3). Six fires were initiated in Boulder Creek Drainage. Five fires began outside the drainage and spread into the project area (Map 3). Two fires in the drainage were less than 10 acres and one fire was greater than 100 acres. Fires in the Boulder Creek Drainage were treated as suppression fires and actions were taken to limit their growth and extinguish them. The 2010 Sheep Fire is the exception. This fire was treated as a managed wildfire and only one half acre crossed into the Boulder Creek drainage.

Table 3: Fires by year, size, action taken and cause within the Boulder Creek Project area.

Fire Name	Year	Acres	Suppression	Cause
Converse	1931	20.6	Suppression	9- Misc
Unknown	1934	157.8	Suppression	9- Misc
Unknown	1933	55.5	Suppression	9- Misc
Wren	1932	36.2	Suppression	9- Misc
Unknown	1922	10.5	Suppression	1- Lightning
Unknown	1928	44.2	Suppression	9- Misc.
Unknown	1919	9.2	Suppression	9- Misc.
Unknown	1916	61.8	Suppression	9- Misc.
Unknown	1947	40.2	Suppression	1- Lightning
Unknown	1926	11.8	Suppression	1- Lightning
Sheep Fire	2010	0.4	Resource Benefit	1- Lightning

Map 3: Fire history in Boulder Creek and surrounding area.



Alternatives and Mitigation

Alternative 1 – No Action

Current management plans under the No Action Alternative would continue to guide management of the project area. No prescribed fire activities would be implemented to accomplish project goals. Therefore special mitigations would not be necessary under this alternative.

Alternative 2 – Proposed Action

Alternative 2 proposes to use prescribed fire to reintroduce fire into the lower portion of the Boulder Creek drainage. The project area encompasses approximately 14,385 acres of the watershed, of which 6,000 to 9,000 acres would be proposed for underburning (Map 4). The smaller amount of treatment acres is due to large areas of rock and other features that would need other treatments prior to, or instead of, prescribed fire.

The project area boundaries include the Sheep Fire edge and Deer Meadow Trail (Forest Trail (FT) 30E05) on the east, portions of Big Meadows and Burton Pass roads (Forest Road (FR) 14S11 and 14S02 respectively) on the south, a portion of Forest Road (FR) 13S26 on the west, and State Highway 180 and the Kings River on the north. The project area includes portions of Monarch Wilderness, Agnew Roadless Area, the Wild and Scenic South Fork of the Kings River, giant sequoia groves (Agnew, Deer Meadow and Evans Complex), and the proposed Windy Gulch Geologic Area as shown in the 2010 Giant Sequoia National Monument Draft Environmental Impact Statement. A grove fuel load reduction plan has been written for the Agnew, Deer Meadow, and Evans Complex Giant Sequoia Groves and is available upon request.

Smoke management is a critical issue in the San Joaquin Airshed. This project is being designed to limit the impact smoke would have on the airshed. Prescribed fires would be ignited in the fall, with some limited ignitions in the spring, one or two weeks prior to a predicted rain/snow event. This would allow the prescribed fire to burn long enough to achieve resource goals before wetting rains or snow extinguish the active burning in the project area. The duration of active burning and smoke impact on the airshed is expected to be two weeks.

The project area would be burned in sections over approximately 5 years (Map 4). The burn treatments would begin on the east side of Boulder Creek in year one and work in a counter-clockwise direction over the years. The following paragraphs provide detailed descriptions of each area. Each burn would use the previous year's activities as a buffer and fuel break for the next treatment area.
The treatments are designed to reintroduce fire and produce a mosaic of age classes, tree size and species composition across the landscape. No mechanical treatments or removal of logs or other forest products is proposed under this project.

After the prescribed burn treatments, hand crews would repair trail tread if the burning activities damaged the trail (i.e., Kanawyer Trail). The tread work may include re-establishing waterbars or other drainage features along the trail. These activities would be designed to reduce the potential for erosion or sedimentation as a result of the fuels reduction activities, and manage that portion of trail to standard.

Area 1: Fall (2013)

As shown on Figure 3, Area 1 is on the east side of Boulder Creek. Area 1 would burn vegetation between Boulder Creek on the west and Deer Meadow Trail (FT 30E05) and the Sheep Fire on the east. The treatment would start along the Deer Meadow Trail, and extend north to Kings River and south to the ridge forming Footman Canyon. The following paragraphs describe the proposed ignition pattern.

Fire would be ignited in three stages. The first stage would be hand ignition (such as drip torch) beginning on the Deer Meadow Trail above the Deer Meadow and Agnew Giant Sequoia Groves. In this portion of Deer Meadow Trail prescribed fire would be lit along the trail edge and allowed to back off the ridge line and into the groves. In the groves hand ignitions would continue to maintain an even backing fire front and prevent high intensity fire burning upslope in pockets of unburned fuel. This order of operations and techniques would keep the flame lengths and rates of spread in the grove area at a moderate level (1 to 3 foot flame length, 1 to 15 chains per hour rate of spread) to avoid unwanted loss of sequoias.

The second stage of ignition would be two pronged, and begin once burning operations in the groves are 2/3 complete. Hand lighting would be used north from the groves along the ridge toward the Kanawyer Trail (FT 30E04). Where the Kanawyer Trail extends about ¼ mile into Monarch Wilderness the fire would be allowed to back downslope off ridgeline.

Simultaneously, the second prong of stage two, would hand light the along the portion of Deer Meadow from the sequoia groves south to the southern boundary of Area 1 which is the top of Footman Canyon. At the ridge south of Footman Canyon fire would be allowed to extend in a westerly direction until it meets Boulder Creek (the western boundary). A control line would not be constructed on this ridge; instead fire would be allowed to back over the ridge to the south into Area 4B (see Map 4). Fire would only be allowed to creep in Area 4B for up to one to two weeks (i.e., until the predicted rain/snow event occurs).

Though trail maintenance is an on-going activity, as part of this project, Deer Meadow Trail would be maintained through trail tread work and brushing along the trail prior to prescribed burning. This maintenance work would allow the trail to serve as a barrier during the burn to mitigate the potential for fire to cross at locations south of where the Sheep Fire burned.

Stage three would begin once the hand ignition is completed on the ridge and the sequoia grove area (stage two). Stage three would light fire from an aircraft (aerial ignition) such as a spherical incendiary device (SID) from a helicopter, as shown in Subareas 1e and 1f. The aerial ignition would focus on helping the fire to back down the ridge and down slope toward the creek in a uniform manner.[1] Fire would also be ignited using aerial ignitions, where necessary, on the east-west ridges

Area 2: Years 2 – 5

Area 2 is located northwest of Area 1 and bounded by Boulder Creek on the east, Forest Road (FR) 13S05 (Camp 7 Road) on the south, the Kings River on the north, and a combination of Forest Service roads and hand line on the west side (See discussion of Area 3 under Phase Three below).

[1] Since fire can burn faster in different fuels, there is the potential for a section of the flame front to reach the bottom of the ridge faster than other sections. This scenario can result in a large scale upslope run of high intensity fire that cannot be controlled. The aerial ignition would help keep an even flame front and prevent a large scale upslope run.

Due to cultural resource concerns and recreation activities in the vicinity of Evans Grove Complex, fire would be ignited only in portions of this area. Along FR 13S05 and FT 30E04 (Kanawyer Trail) on the southern edge of the area, only hand lighting would occur. This hand lighting would extend approximately 100 feet north of the road and/or trail and any other resources that may be susceptible to fire damage in this vicinity. A small amount of control line may be created by hand in this area to protect individual resources (such as wooden features).

Continuing to the north in Area 2, prescribed fire operations would be a combination of aerial and hand ignition (Map 4). From the wilderness boundary and continuing north the terrain becomes steeper as you go toward the South Fork Kings River. Aerial ignition would occur along the ridges in this portion of Area 2, and fire would be allowed to back down the slopes naturally toward the Kings River until the predicted rain/snow event arrives.

Area 3: Years 2 – 5

Area 3 is broken down into three subareas: A, B and C which are interspersed among areas of no planned ignition treatments (Area 4). Area 3 A, B and C would have similar treatment guidelines as described above for Areas 1 and 2. This is the only area that includes spring burning, and is located in the southern portion of the project area (Map 4).

This phase of the burning would include the numerous young conifer plantations in the southern project area. Identified burn areas would be divided into small units of 40 to 100 acres, and would be burned over one or two days per unit. In addition, due to the timing of the burning, wildlife surveys would need to be conducted. If active California spotted owl or northern goshawk nests were found, handline may need to be constructed or the burn unit boundary modified to ensure nesting areas are not negatively affected by the prescribed burning.

In portions of Area 3, specifically 3A within Evans Grove Complex, there are known cultural resources and recreation facilities that may need protection during or after burn treatments. To protect cultural resources, fire control lines or fuel breaks may be constructed by hand crews, or fire would be lit under a prescription for low intensity to reduce fuels while avoiding damage to fire resistant resources (i.e., bedrock mortar overgrown by brush).

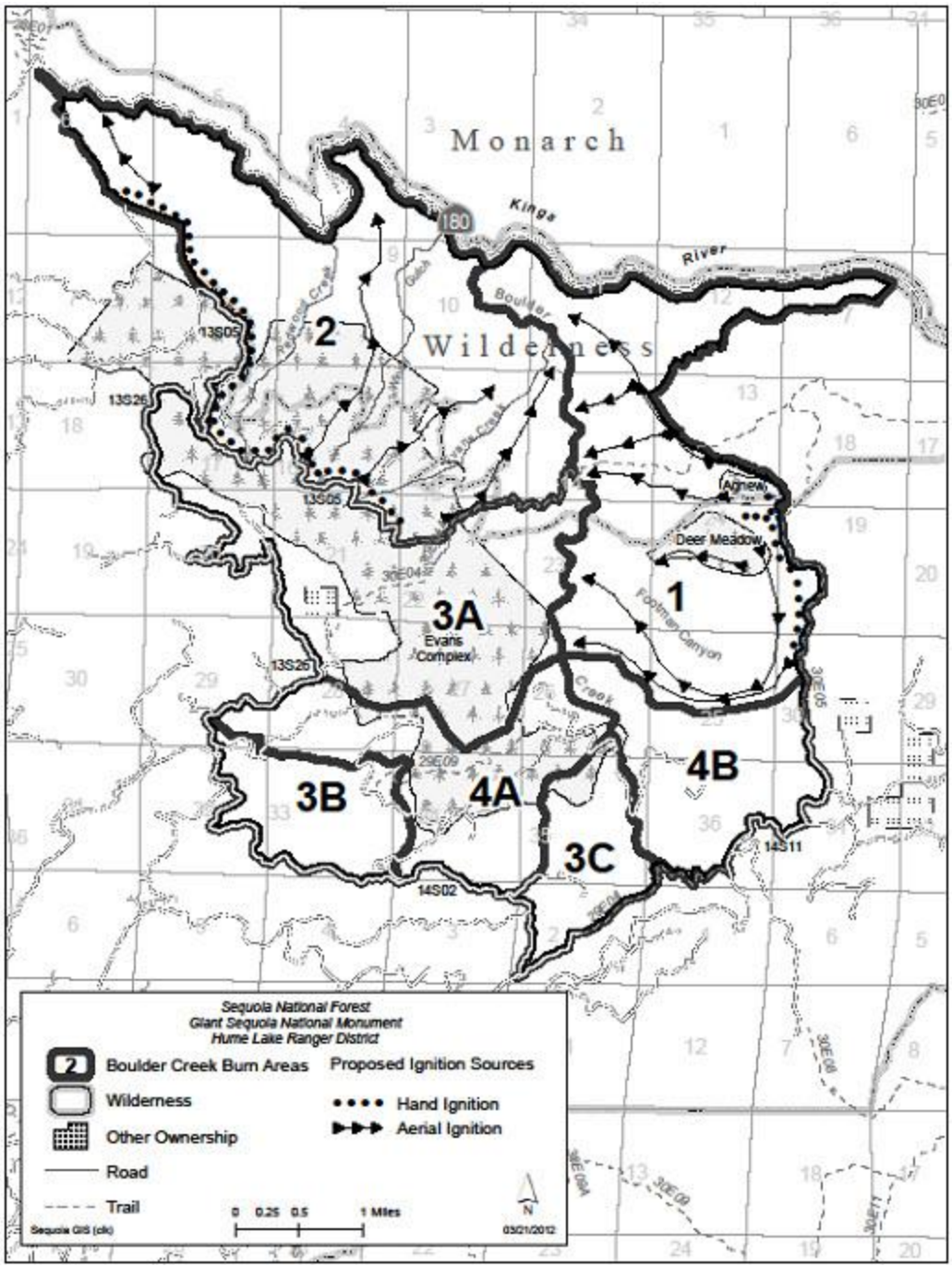
The smaller burn units and shorter burn durations would allow fire managers to reintroduce fire to the landscape under controlled conditions without unwanted ignitions encroaching into plantations or sensitive cultural resource sites. This is slower and more costly, but gives the burn boss more control over timetables and fire intensities. The specific unit areas have not been identified. Unit designations would occur as specialists are able to analyze and help identify areas that can be burned without negatively affecting other resources or objects of interest.

Area 4

Area 4 is broken down into two subareas: A and B which are planned for no active ignition treatments at this time (Map 4). Several existing plantations are located in Area 4 and the vegetation is currently a mix of trees and brush which form a contiguous pocket of ladder fuels. Prescribed burning in these plantations, especially Area 4A, would likely result in a fire that would burn most of the trees and the reforestation investment they represent.

However, Area 4B contains more wild stands intermixed with plantations, so fire would not be excluded if it enters the general area from the treatments proposed in Area 1. Instead, fire would only be allowed to creep in Area 4B for up to one to two weeks (i.e., until the predicted rain/snow event occurs), and would be closely monitored and managed to minimize damage to the planted trees and the reforestation investment they represent. In the event that fire threatens these plantations south of Footman Canyon, minimally invasive suppression actions (i.e., hose lays, existing road systems, or narrow hand constructed fire control line) would be used to protect resources.

Map 4: Boulder Creek project area and prescribed fire unit boundaries


Monarch
Wilderness
Kings
River
180
2
3A
Evans
Complex
1
3B
4A
4B
3C
Agnew
Deer Meadow
13S05
13S26
13S25
14S02
14S11
Sequoia National Forest
Giant Sequoia National Monument
Hume Lake Ranger District
Boulder Creek Burn Areas
Wilderness
Other Ownership
Road
Trail
Proposed Ignition Sources
Hand Ignition
Aerial Ignition
0 0.25 0.5 1 Miles
N
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Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects
The existing fuel conditions and their associated fire risks are likely to be maintained and continue to increase with time under the No Action Alternative.

Fire severity and intensity would continue to increase as fuel loading naturally increases. Flame lengths and rates of spread would continue to support passive and active crown fire. In the event of a wildfire, safe firefighter access would continue to decline with no treatment of fuels within the project area as fuel accumulates within travel corridors.

Fire Return Interval Departure (FRID) for the project area would potentially continue to remain outside of historic fire return intervals. An increase in surface fuels would occur over time as existing snags, needle cast, and woody debris continue to accumulate. Snag densities are anticipated to increase with naturally occurring tree mortality. Ladder fuels are also anticipated to increase as regeneration continues and in turn decreases the average canopy base height within the project area.

Cumulative Effects
The cumulative effect area for this analysis is considered to be the planning area for this project and bordering lands within the Giant Sequoia National Monument and adjacent Sequoia and Kings Canyon National Parks.

Under the No Action Alternative, current fuel loading conditions will continue to degrade. The shade tolerant tree species would continue to increase, providing the ladder to move fire into the crowns of the larger trees. Surface fuels would continue to exist and be expected to increase with no actions taken to reduce fuel loadings. In these conditions, current and future wildfires are expected to exceed capabilities of ground fire fighters to control the spread of the fire.

The safety risk for fire fighters and the public is high in areas of heavy fuel loadings. The risk level will continue to grow in the future as fuel loading continues to increase with no treatment action.

Short term smoke emissions would be low because no burning would occur in the No Action Alternative, until the occurrence of a wildfire. Over the long term a wildfire is likely and a large increase of emissions from smoke during a wildfire would be expected. With no treatment, the ability to manage wildfires and prescribed fires to achieve fuel management and resource objectives would be difficult due to current fuel loading and forest stand characteristics that result in the potential for extreme fire behavior.

Alternative 2 – Proposed Action

Direct and Indirect Effects
Alternative 2 proposes to reintroduce fire into the lower portion of the Boulder Creek drainage. This proposed action utilizes prescribed fire to restore ecological processes within areas of extreme FRID. Using fire as a tool helps to restore landscape structure and heterogeneity, as well as produce fire effects associated with natural diversity.

Prescribed fire treatments would be designed to reintroduce the effects of fire and create a mosaic of vegetation age classes, tree sizes, and species composition across the landscape.

Effects associated with this alternative include the reduction of surface fuel loading and ladder fuels, resulting in moving the project area toward fire and fuels management desired conditions. The vertical and horizontal continuity of the fuel loading which provides a ladder for fire to transition from the ground to the crowns of the trees would be modified to support a low intensity surface fire.

Actions proposed in Alternative 2 would provide giant sequoia groves in the project area protection from future uncharacteristically severe wildfire by reintroducing fire to restore and conserve grove ecosystems. Re-establishment of fire in fire excluded giant sequoia groves helps to restore these ecosystems and promote resilience.

Connectivity with this project and the 2010 Sheep Fire strategically provides an area of reduced fuel loading and continuity, slowing the rate of spread and decreasing flame lengths of future high intensity wildfires burning in the area. The recent Sheep Fire, located to the east of the project area, currently provides a window of opportunity allowing more flexibility to accomplish what would otherwise be a higher risk burn.

The proposed action is projected to significantly reduce passive crown fire activity to surface fire between 27 and 56 percent of the burnable area (Table 4; Figure 6-7). Flames lengths are reduced from 11+ feet to as low as 0-4 feet in a high percentage of the burnable area (Table 5; Figures 8-9). A four-foot flame length is considered the maximum height that can be safely attacked by hand crews to create fire lines near the fire. Fireline intensity is reduced from as high as 1000 BTUs to as low as 0-100 BTUs in much of the area (Table 6; Figure 10-11). Rate of spread is lowered from as high as 40-80 chains per hour to less than 5 chains per hour in most of the project area (Table 7; Figure 12-13). Collectively, these parameters describe conditions for future wildfire behavior which resemble historic wildfire; slow moving, low intensity fire with very limited potential for crown fire of any type. It also describes conditions allowing for subsequent low risk, maintenance prescribed fire or managed wildfire in the future.

Over the short term, smoke emissions would be greater under the proposed action alternative due to prescribed burning. However, over the long term smoke emissions from future wildfires would be reduced. This reduction is because cumulative smoke produced by prescribed burning and low intensity fires resulting from fuel reductions is less than smoke produced by high intensity wildfires that occur where no fuel reductions have taken place.

Prescribed fires would be ignited in the fall, with some limited ignitions in the spring, one or two weeks prior to a predicted rain or snow event. This would allow the prescribed fire to burn long enough to achieve resource goals before wetting rains or snow extinguish the active burning in the project area. The duration of active burning and smoke impact on the San Joaquin airshed is expected to be two weeks.

Cumulative Effects

Past, present and future activities within and near the project area include prescribed fire activities and managed wildfire. Most recently, in the summer of 2010, the Sequoia National Forest jointly managed the Sheep wildfire with Sequoia and Kings Canyon National Parks for over 9,000 acres adjacent to the

project area. This fire successfully lowered hazardous fuel loading on fifty-two acres within the Monarch Giant Sequoia Grove.

Fuel management actions in Alternative 2 would result in a positive benefit in contributing to the reduction of potential fire behavior and moving towards fire and fuels management desired conditions.

Table 4: Projected Surface and Crown Fire Activity by Alternative

Surface and Crown Fire Activity (Percent of Burnable Area)						
	Alt. 1/Area 1	Alt. 1/Area 2	Alt. 1/Area 3	Alt. 2/Area 1	Alt. 2/Area 2	Alt. 2/Area 3
Surface	36	46	71	92	86	98
Passive	63	53	29	8	14	2
Active	1	1	0	0	0	0

Figure 6: Surface and Crown Fire Activity – Percent of Burnable Area

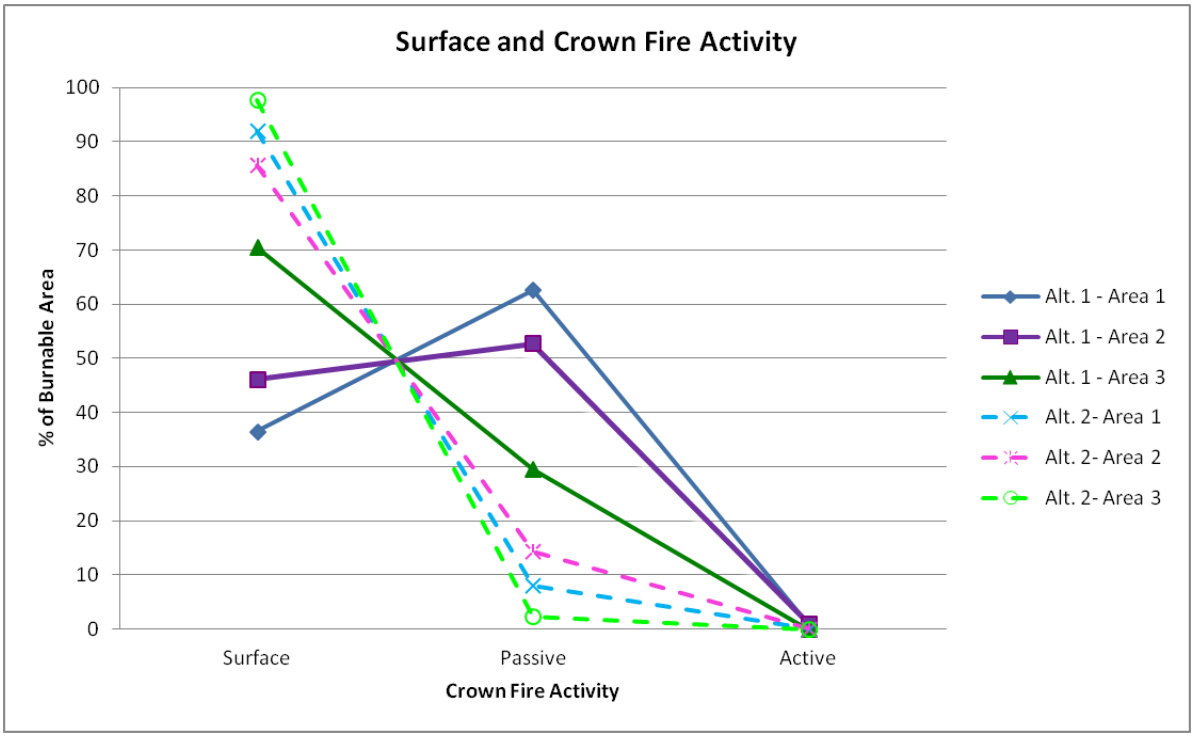


Figure 7: Projected surface and crown fire activity for Alternatives 1 and 2

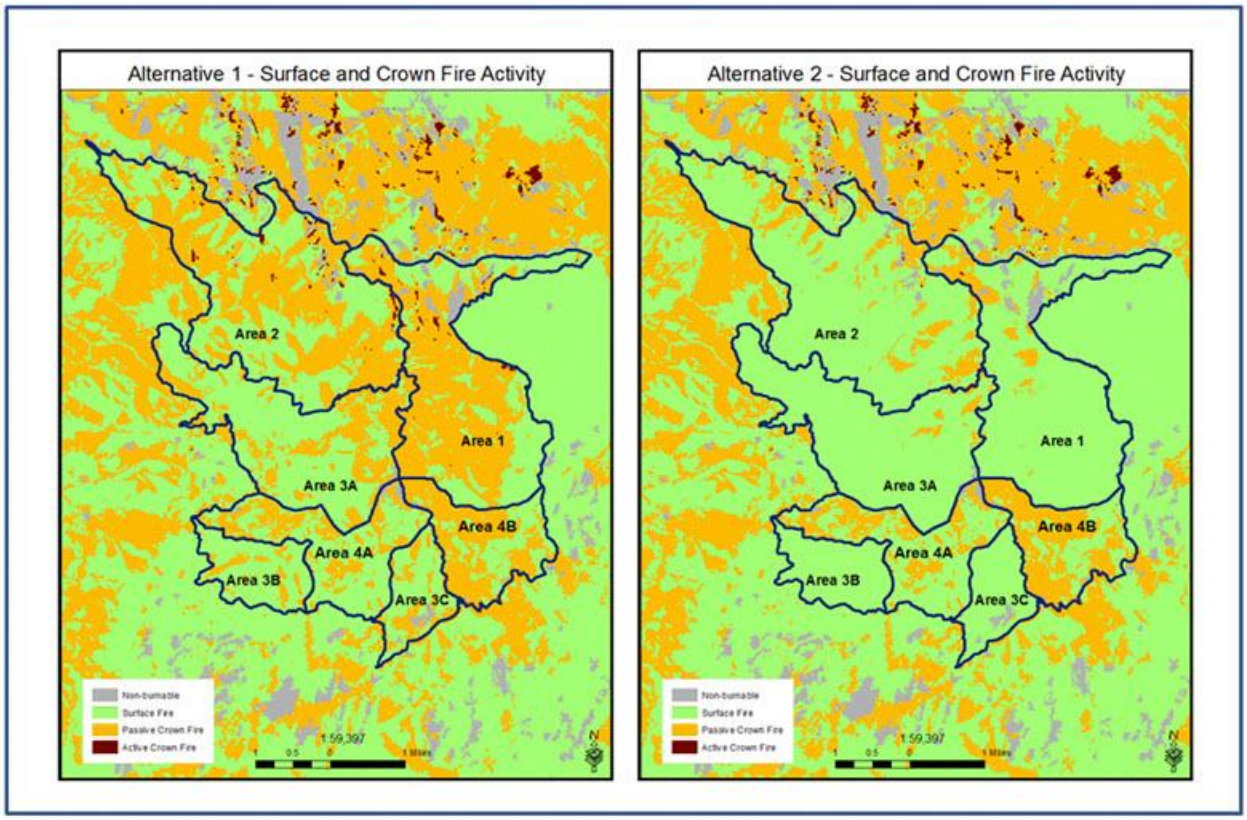


Table 5: Projected Flame Length (ft) by Alternative

Flame Length (Percent of Burnable Area)						
Feet	Alt. 1/Area 1	Alt. 1/Area 2	Alt. 1/Area 3	Alt. 2/Area 1	Alt. 2/Area 2	Alt. 2/Area 3
0-4	39	48	76	94	93	99
4-8	10	11	12	5	6	1
8-12	13	8	4	0	0	0
11+	39	34	8	0	0	0

Figure 8: Flame Length (ft) – Percent of Burnable Area

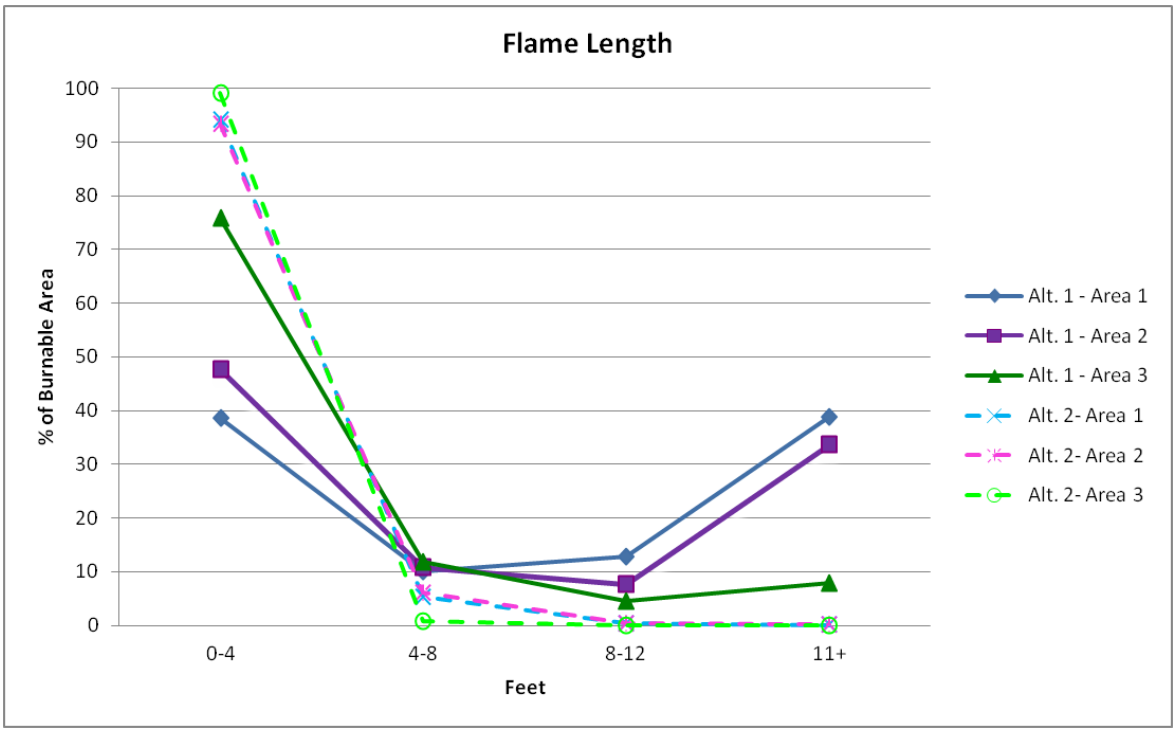


Figure 9: Projected flame lengths for Alternatives 1 and 2

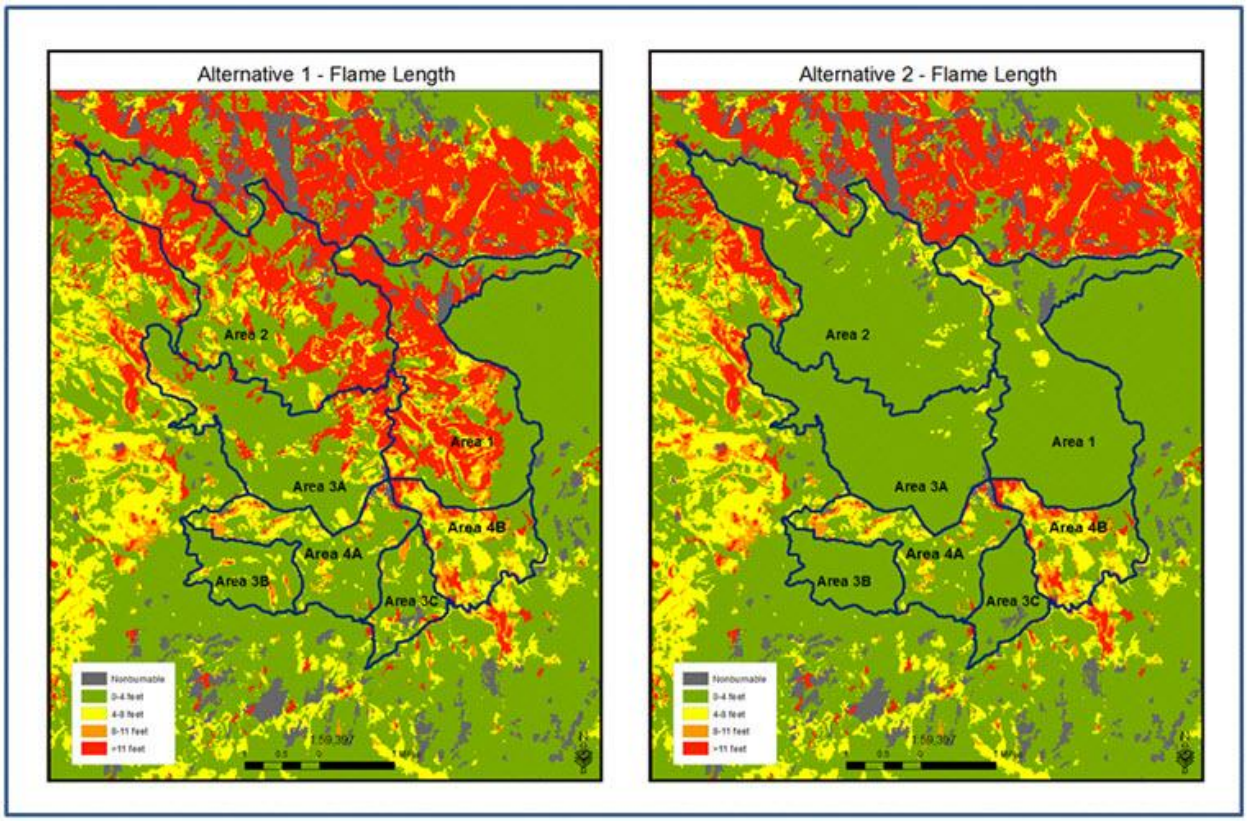


Table 6: Projected Fireline Intensity (BTU) by Alternative

Fireline Intensity (Percent of Burnable Area)						
BTU's	Alt. 1/Area 1	Alt. 1/Area 2	Alt. 1/Area 3	Alt. 2/Area 1	Alt. 2/Area 2	Alt. 2/Area 3
0-100	39	48	77	94	93	99
100-500	29	21	17	5	6	1
500-1000	17	13	4	0	0	0
1,000+	16	17	3	0	0	0

Figure 10: Fireline Intensity (BTU) – Percent of Burnable Area

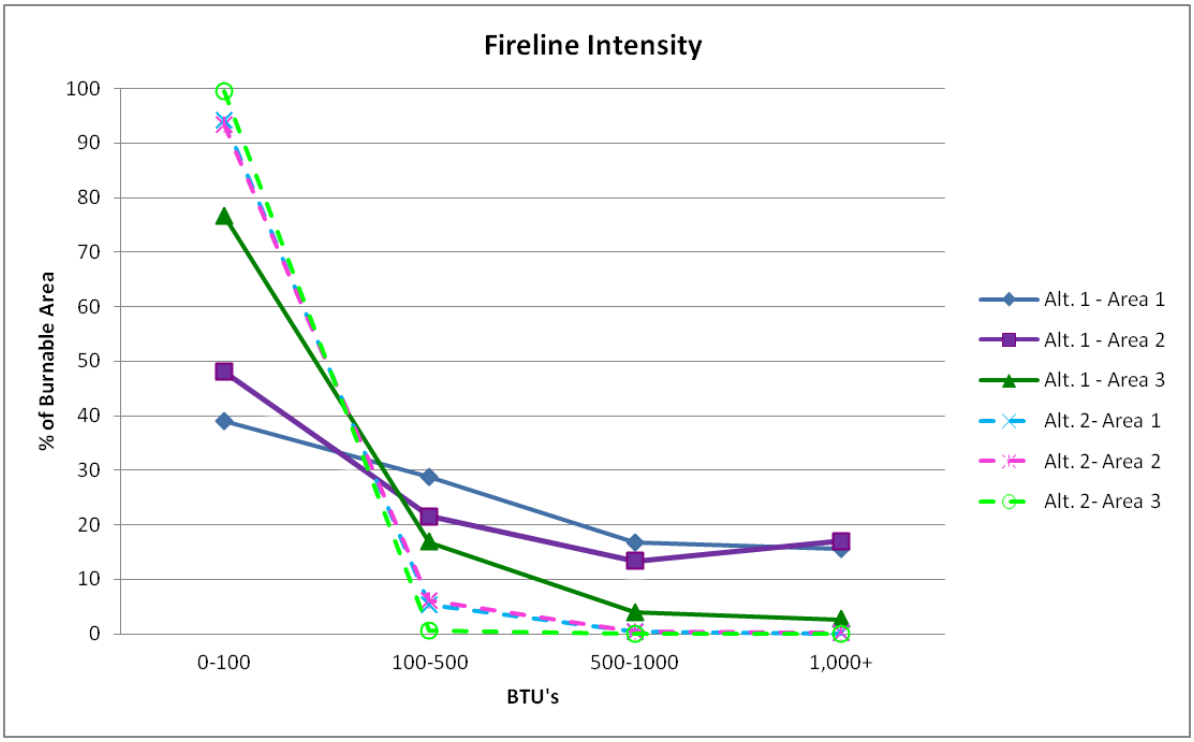


Figure 11: Projected Fireline Intensity for Alternatives 1 and 2

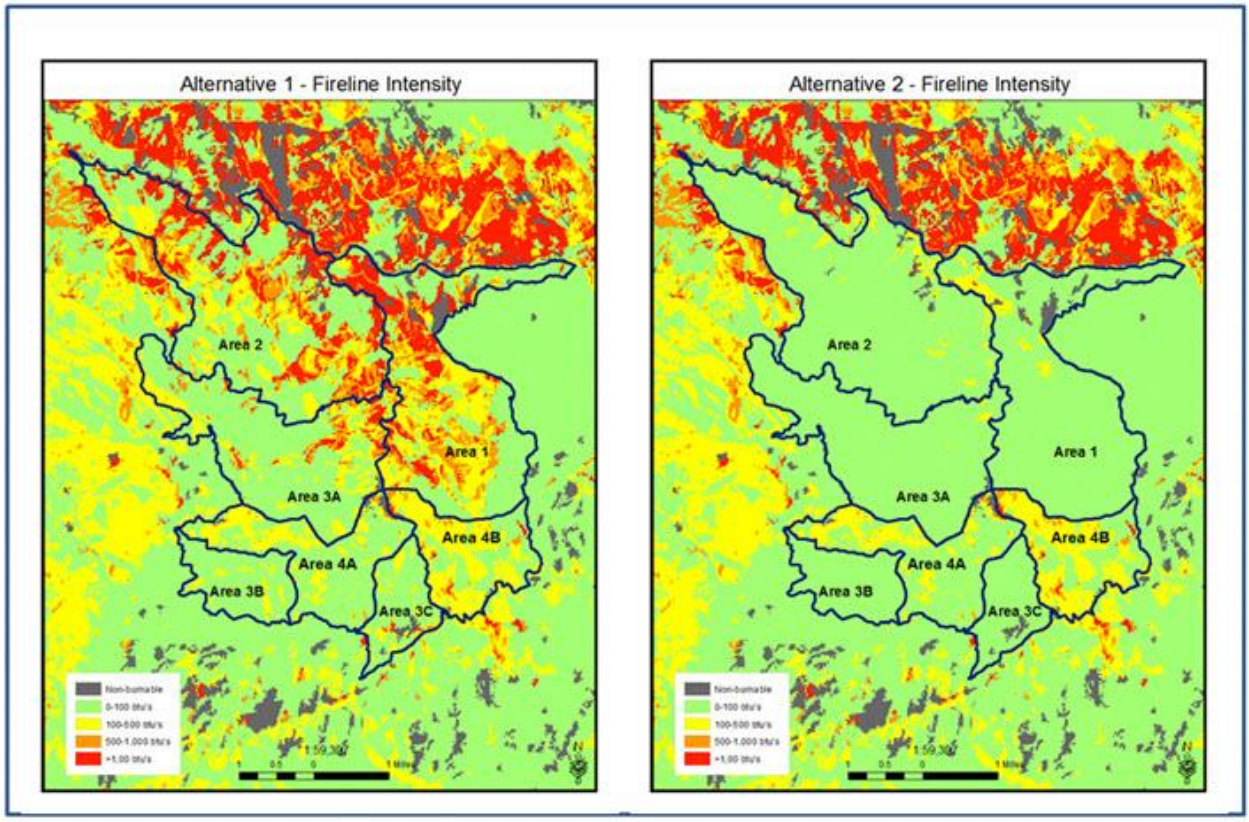


Table 5: Projected Rate of Spread (chains/hour) by Alternative

Rate of Spread (Percent of Burnable Area)						
Chains/Hr	Alt. 1/Area 1	Alt. 1/Area 2	Alt. 1/Area 3	Alt. 2/Area 1	Alt. 2/Area 2	Alt. 2/Area 3
0 -5	52	57	88	93	95	99
5-10	27	12	6	6	5	1
10-20	9	10	3	1	0	0
20-40	5	11	3	0	0	0
40-80	6	7	1	0	0	0
80+	1	2	0	0	0	0

Figure 12: Rate of Spread (chains/hour)

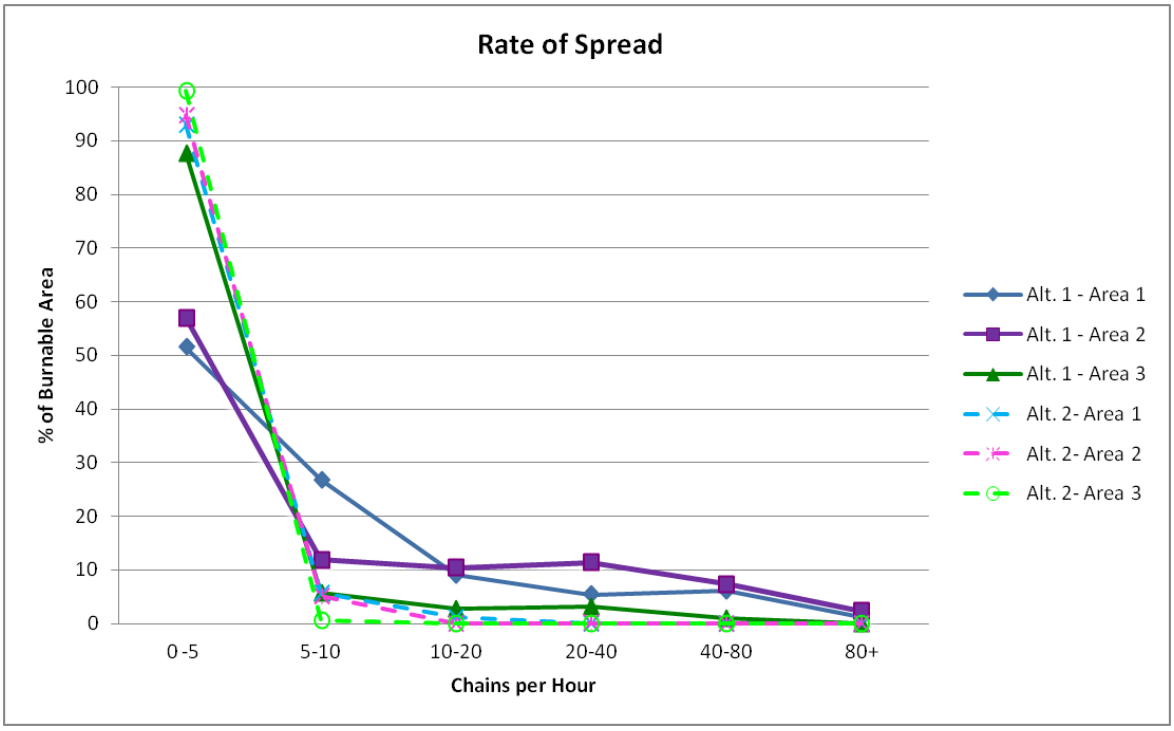
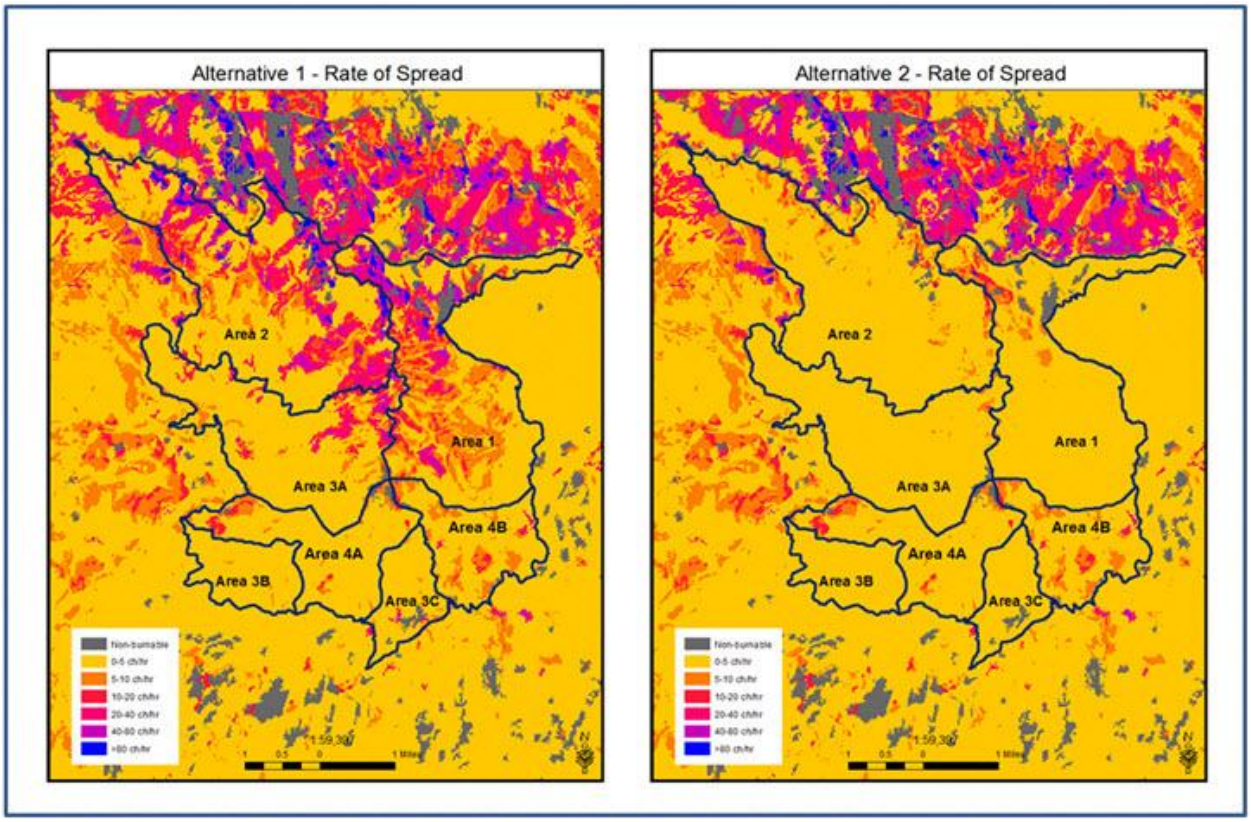


Figure 13: Projected Rate of Spread for Alternatives 1 and 2



References

Clinton, W.J. 2000 (April 25). Establishment of the Giant Sequoia National Monument by the President of the United States of America. Proclamation 7295 of April 15, 2000. Federal Register 65(80): 24095-24100.

Kilgore, B.M. and D. Taylor. 1979. Fire history of a sequoia mixed-conifer forest. Ecol. 60:129-142.

Scott and Burgan. 2005. A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model.

Sequoia National Forest and Giant Sequoia National Monument, Hume Lake Ranger District, 2012. Agnew, Deer Meadow, and Evans Complex Giant Sequoia Grove Fuel Load Reduction Plan.

Swetnam, T.W., C.H. Baisan, A. C. Caprio, R. Touchan, and P.M. Brown, 1992. Tree-ring reconstruction of giant sequoia fire regimes. Final report on Cooperative Agreement DOI 8018-1-0002 to National Park Service. Sequoia and Kings Canyon National Parks, California.

Swetnam, T.W. 1993. Fire history and climate change in giant sequoia groves. Science 262:885-89.

U.S. Department of Agriculture (USDA), Forest Service, 1988. Sequoia National Forest land and resource management plan. Porterville, CA: Sequoia National Forest. 225p.

U.S. Department of Agriculture (USDA), Forest Service. 1990. Sequoia National Forest land management plan settlement agreement (mediated settlement agreement - MSA). Porterville, CA: Sequoia National Forest. 171p.

U.S. Department of Agriculture (USDA), Forest Service, 2001. Sierra Nevada forest plan amendment, final environmental impact statement, record of decision, Vallejo, CA: Pacific Southwest Region. 55 p.

U.S. Department of Agriculture (USDA), Forest Service, Sequoia National Forest, 2012. Giant Sequoia National Monument Final Environmental Impact Statement.